

# Skylab: America's First Space Station

## Part I—The History Of Skylab



For about 3 years, human beings have lived continuously in Earth orbit aboard the International Space Station (ISS). This magnificent facility serves as both home and laboratory for scientists who conduct fantastic research in the microgravity of space. But, this technological marvel would likely not have been possible without another space station—America's first space station, Skylab. Tucked between the end of the Apollo Moon landing program and the beginning of the Space Shuttle program, the Skylab program proved that it was possible for human beings to live and work in outer space for extended periods of time and paved the way for future life in Earth orbit—and, eventually, beyond.

The Skylab program began with the launch of the station on May 14, 1973 and continued until the return of the third and final crew on Feb. 8, 1974. Skylab served as the greatest solar observatory of its time, an orbiting microgravity laboratory for unprecedented scientific experiments, a facility for learning more about the planet Earth in an entirely new way, a medical lab for studying the effects of microgravity on the human body, a workshop for new methods of in-space repair and housekeeping, and, most importantly, a home away from home for its trio of three-person crews.

The Skylab station weighed a total of nearly 90,000 kilograms (100 tons), and had about the same volume as a small three-bedroom house. Its resources combined equipment found in radio and television stations, scientific and manufacturing laboratories, photography studios, and astronomy observatories. Its Apollo Telescope Mount, which was used to perform observations of the Sun impossible from Earth's surface, included eight separate solar experiments: two X-ray telescopes, an X-ray and extreme ultraviolet camera, an ultraviolet spectroheliometer, an extreme ultraviolet spectroheliograph and an ultraviolet spectroheliograph, a white light coronagraph, and two hydrogen-alpha telescopes.



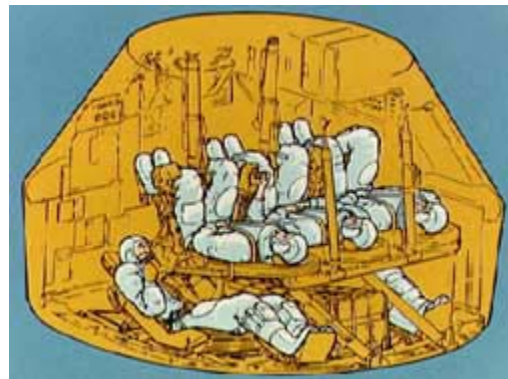
The Skylab program began with an inauspicious start when the station was launched in May 1973 atop a Saturn V rocket like the ones used for the Moon landing missions. Airflow caused a meteoroid shield to come off during lift-off. The shield ripped off one



of Skylab's two solar panels as it came off, and a piece of the shield wrapped around the other solar panel, preventing it from deploying. The launch of the first Skylab crew, originally scheduled for the next day, was delayed as engineers figured out how to solve the problems caused by the damage. When the first crew flew to the station 11 days later, their first priority was to conduct substantial repairs.

Astronaut Joe Kerwin, a member of the first Skylab crew, told NASAexplodes that while life eventually became routine on the station, "the first 2 weeks of our existence up there were not." The damage during launch had seriously limited the power supply available for the Skylab crew, so they had to make some adjustments in their planned orbital lifestyle until the repairs were completed. "We were not allowed to have hot coffee because there was not enough electricity," Kerwin said. After the repairs were completed, he said, "we had plenty of power, so we fell into a routine."

The second Skylab crew also faced a problem on its way to the station. As the Apollo craft was on its way to the station, crew member Jack Lousma noticed something out the window. "Jack said, 'There goes one of the nozzles, floating by our spacecraft,'" second crew astronaut Owen Garriott said. It was determined that what Lousma had seen was not actually an engine nozzle, but a piece of ice that had formed in one of the attitude control thrusters and thus bore its shape. That ice, however, was a sign of another problem—a leak in the engine system. That thruster and the corresponding thruster on the opposite side were secured and shut down, forcing Commander Alan Bean to make a far more challenging rendezvous with Skylab than had been planned. "We had to encourage Alan a couple of times during the rendezvous, 'Slow down! Slow down!'" Garriott said. Once the crew was aboard the station, a second thruster also developed a leak. Ground controllers feared that additional leaks might prevent the crew from being able to use that Apollo craft to return home. A rescue mission was planned, and modifications were designed to allow an Apollo capsule to carry five people instead of three. Two astronauts would have flown to Skylab and brought the three crew members there back home. "They prepared for the rescue mission, but they didn't have to fly it," Garriott said. The capsule that carried the crew to Skylab also brought them safely home.



Three crews of astronauts served aboard Skylab. The first Skylab crew consisted of Pete Conrad, Paul Weitz, and Kerwin. Conrad, the commander, had also served as the

commander of the second Apollo Moon landing. The first crew spent a total of 28 days in orbit, from May 25 until June 22, 1973. Each of the Skylab crews set new spaceflight duration records, and the record set by the final crew was not broken by an American astronaut until the Shuttle-Mir program over 20 years later. The second Skylab crew consisted of Alan Bean, Jack Lousma, and Garriott. Like Conrad, Bean had also walked on the Moon during the Apollo 12 mission. The second crew spent a total of 59 days in space, from July 28 until Sept. 25, 1973. The final Skylab crew consisted of Jerry Carr, Bill Pogue, and Edward Gibson, all three of whom were spaceflight rookies. They spent a total of 84 days in space, from Nov. 16, 1973 until Feb. 8, 1974.

Skylab opened up numerous scientific opportunities for NASA and the nation. Since it allowed each crew to set new records for spaceflight duration, studying the physical effects of continued microgravity exposure was an important part of the research. Astronauts performed extensive astronomical research, including capturing numerous images of comets and obtaining unprecedented information about the Sun. In addition to



turning their attention out into the solar system, the Skylab crews also focused on Earth, gathering new data about our home planet. Students from around the nation were allowed to design and submit experiments to be performed on the Skylab station. Possibly the most famous of the 17 student experiments performed in space were a pair of spiders, Arabella and Anita, who demonstrated that they could still spin webs in microgravity (According to Garriott, the girl who proposed the experiment later went on to become a doctor).

The crews' long stays on the station meant that new technology had to be developed for their day-to-day living. Engineers developed new showers, toilets, sleeping bags, exercise equipment, and kitchen facilities designed to function in microgravity.

After the last crew left the station, Skylab was moved into an orbit where it was expected to stay for 8 to 10 years, and was shut down. Originally, plans were for the Space Shuttle to visit Skylab after the orbiter fleet became operational. In fact, Carr said, before they left, his crew even left a "time capsule" for future astronaut visitors, consisting of items chosen by Mission Control to see how they would respond to long-term spaceflight exposure. However, greater-than-predicted solar activity altered the station's orbit, and on July 11, 1979, Skylab re-entered the





Earth's atmosphere and disintegrated, dispersing debris across a sparsely populated section of western Australia and the southeastern Indian Ocean. (Australia reportedly fined NASA \$400 because of this—for littering!)

“There was a certain small amount of sadness when we left, realizing we were going to be the last crew to inhabit the spacecraft,” Carr said. “It had hung together beautifully for us, and we kind of hated to leave it. But, of course, we were also looking forward to going home.”

## Part II—Life On Skylab



As America's first space station, one of Skylab's most important functions was to study the feasibility of long-duration space missions. As a result, the ongoing activities of astronauts just going about their daily lives in orbit was one of the greatest of all the scientific experiments aboard the station. Though they were free-falling in Earth orbit, traveling at 16,000 miles per hour, the Skylab crew members said that everyday life on the station was actually pretty normal.

Days began on Skylab at 6 a.m. (Houston time) and lasted until 10 p.m. Second-crew astronaut Owen Garriott noted, though, that before you talk about what an average day was like on Skylab, you have to establish what the word day means. “Here we are cruising around the world at about 16,000 miles per hour, so we see sunrises about every hour and a half,” he told NASAexplores. Joe Kerwin, a member of the first crew, said that at the beginning of each day on Skylab, the astronauts would check the teletype machine to see what their orders were for that day from Mission Control. After checking the daily plans, the astronauts would use the restroom, weigh, and then eat breakfast.

After that, the crew would begin working on their daily science assignments. Those duties, Kerwin said, would rotate every day. Each took turns on things such as solar observation, and the astronaut who was the “guinea pig” for the medical evaluations one day would be performing those same evaluations on one of his crew mates the next, according to Jerry Carr, an astronaut on the final Skylab crew. “One of us was on the Apollo Telescope Mount



(ATM) pretty much every day,” he said. “And, there was always housekeeping to be done.” In addition to cleaning the bathroom and general household straightening, another regular housekeeping task was vacuuming the filters for the air circulation system. “Any debris that got loose in the spacecraft would eventually get caught in the intake screen of the scrubbers,” Carr said. “It was sort of the lost and found.” In other words, the crew stayed busy. “Our days were pretty full,” Carr said.

Kerwin agreed, saying, “The day would go by very fully packed with these experiments.” After the science experiments for the day were completed, “between 8 and 10 at night, we had free time,” Carr said. One popular activity was watching the Earth as it passed below. “Looking out the window at night was a big treat,” Kerwin said. Carr agreed, “For the most part, the most fun was looking out the window.” Each crew member was allowed to talk to his family once every 3 days. Special phones were installed so that families could talk to the astronauts from their homes. For the Skylab astronauts, duty hours were packed with science experiments, and off-duty free time was often filled with...more science experiments. “We had a number of other things to do,” Garriott said. “We had the student experiments, for example.”



The crews also devised their own small experiments, demonstrating how various things behaved differently in microgravity. Some of those experiments were later turned into educational videos that revealed the wonders of near-weightlessness for students around the world. “I was surprised at how widely these things got distributed,” Garriott said, who said that he enjoyed performing the experiments. “We had supposedly half a day off each week for ‘R and R’ (rest and relaxation),” he said. “To me, that was R and R.” Carr also said he enjoyed performing personal experiments. “It was such an interesting

thing to turn loose a blob of water to see what you can do with it,” he said. . In fact, the astronauts found science far more fun than traditional diversions, Carr said—playing cards and dartboards sent up to entertain the crew were rarely used. “But, looking at the Earth was the best entertainment of all,” he said.

Garriott said his crew tried to maximize what they got done on the station, starting work shortly after they woke up. While one crew member prepared breakfast for all three astronauts, another began the day’s observations on the ATM, while a third took care of station housekeeping. Once the meal was ready, the astronauts “rendezvoused for breakfast,” before resuming their duties, Garriott said. “That’s pretty much how our days went,” he said. “We operated that



ATM panel from the moment we got up to the last orbit before we went to bed.” At night, each astronaut had his own sleeping areas about the size of a telephone booth. Carr noted, “Our beds were fastened against the wall rather than on the floor,” adding that it didn’t matter in microgravity.

Astronauts on Skylab had fun, too, and even pulled one of the classic space pranks on unsuspecting mission controllers. The ground crew was shocked when they heard a female voice calling down from the orbiting station, and asked who it was. “Houston, Roger. I haven’t talked with you for a while,” came the reply from space. “This is Helen (Garriott’s wife) here in Skylab. The boys hadn’t had a home-cooked meal in so long I thought I’d just bring one up. Over.” After describing fires in California that could be seen from the station, the voice went on to say, “Oh, oh, I have to cut off now. I see the boys are floating up toward the command module, and I’m not supposed to be talking to you. See you later.” As the ground-to-space communicator (capcom) Bob Crippen muttered, “Bye, bye,” in a roomful of confused mission controllers, the Skylab crew burst out in laughter. Garriott had made the recording of his wife’s voice months before the flight, and brought the tape with him at launch into space. He had rehearsed the whole thing with Crippen and another capcom earlier in order to pull a prank on the rest of Mission Control. Garriott had made recordings for different situations that might be seen from space, and waited to use it until about the 40<sup>th</sup> day of the flight, when the fires in California were visible from the station and Crippen was working as capcom. “Bob Crippen was actually the only person not confused,” Garriott said. “Crippen knew exactly what was going on. He pulled a little script out of his pocket and he knew exactly what he was supposed to say.”



While not a part of everyday life, extravehicular activities (EVAs), or space walks, were among the highlights of the Skylab experience for those who went on them. “I had the good fortune to go on all three of the EVAs (during the second mission),” Garriott said. EVAs had been scheduled prior to the launch of Skylab in order to change out the film in the ATM. However, once the station was aloft, the EVAs took on an additional purpose—repair of the

station. Each crew implemented a new measure to block sunlight due to the absence of the meteoroid shield, as well as making other repairs on the exterior of the station. During the EVAs, Garriott said, it was a thrill to “look down this very long elevator shaft” to the surface of the Earth. “It’s quite an interesting view,” he said, adding that one of the most memorable vistas came as the station was crossing the Pacific Ocean toward South America, and he could see from the Pacific, across the Andes Mountains, to the Atlantic Ocean. EVAs marked the major holidays for Carr, who spent part of



Thanksgiving and Christmas on two of his three space walks. “It was pretty hard work, but we had practiced it well,” he said.

Although the Skylab crews each spent more time in space than anyone had before, none of the astronauts said they were concerned about any potential effects of the unprecedented spaceflight durations. “We knew we were feeling good,” Garriott said. “Everyone was confident they were in good shape.” One of the medical devices on the station caused additional blood to flow into the legs much as it would on the ground, simulating how the body would feel back in an Earth-gravity environment. Garriott said that this gave the crew confidence that they would be all right when they returned home. “I wasn’t concerned about the duration,” Garriott said. “In fact, I wanted to stay longer.” While the second crew’s mission had only been scheduled to last 56 days, he said, the astronauts convinced flight controllers to let them stay 59 ½ days, eating some of the third crew’s food in the process.



Carr said that the success of the previous missions gave his crew confidence in their longer stay. “We didn’t worry too much about that, because the Skylab program was done in stairsteps,” he said, adding that the mission could have been ended earlier if there had been problems. “We were going on a week-to-week basis for a while.” The astronauts had even been trained as paramedics and had contact with ground-based flight-surgeons, so they would have been prepared if any medical emergencies had arisen. In fact, Carr said, the crew came home when they did mainly because they had run out of food, after rationing it to make it last as long as possible. “That’s the reason why it stopped at 84 days.”



Returning to Earth did take a little adjustment, though. In addition to a few days of readjusting to the physical effects of gravity, the crew members noticed a few other differences as well. Garriott noted that on his first night on Earth, he could not find his way back to his bed after turning off the light. His vestibular system and ability to feel gravity were so altered that he could not navigate without eyesight. He had to turn on a lamp by the bed, then turn off the overhead light, get back in bed, and then turn off the lamp. “You can’t rely on your vestibular system or sense of feel the first few days on the ground,” he said.

Other astronauts, including Carr, forgot that things do not work the same on Earth as they do in space, attempting to let things float as they would in microgravity. “I almost dropped a bottle of urine that had been part of the post-flight medical

(examination),” he said. “And that was just a matter of, I forgot where I was.”

### Part III—The Legacy of Skylab

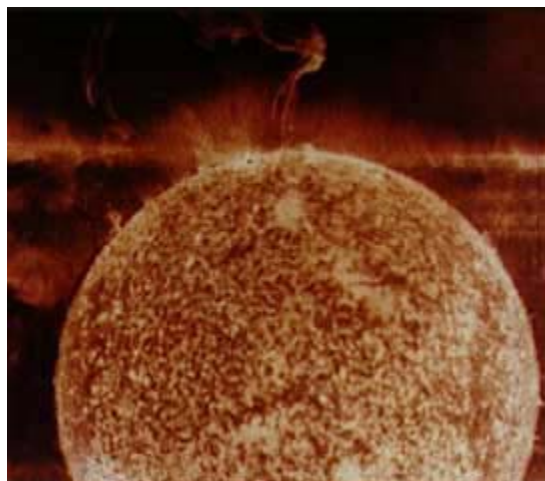


For today’s students, Skylab, which was launched into Earth orbit over 30 years ago, is a part of history that took place long before they were born. However, though long gone, Skylab is still very much an important and relevant part of space exploration. It laid substantial groundwork for future space ventures. In many ways, much of its potential is just now being realized with the International Space Station (ISS). “I think most people would recognize Skylab as the world’s first space station, or at least the U.S.’s first space station,” said Owen Garriott, a member of the second Skylab crew.

“Overall, the greatest accomplishment of Skylab was that it was the basis for a modern space station,” first crew astronaut Joe Kerwin said. Much of the research and technology that makes the ISS possible was still just theory prior to launch of Skylab. “We demonstrated the science effectively,” he said, adding that Skylab also proved that astronauts could conduct valuable research in orbit. Third crew Skylab resident Jerry Carr agreed. “I think the greatest achievement is that we pretty much proved that the human body can stay weightless for a very long time,” Carr told NASAexplores. “This was our first opportunity to go up and settle in.” He said that the Skylab crews also helped develop countermeasures to help astronauts better endure long-duration flights. “I don’t see any reason we couldn’t go to Mars without artificial gravity,” he said.

For Garriott, the greatest accomplishment of participating in Skylab was taking part in the groundbreaking scientific research. He said he enjoyed “the opportunity to assist solar investigators right at the front of their discipline, and the same thing is true for physiology.” He said that due to the extremely meticulous evaluation and recording, some of the Skylab medical data is still the definitive source on effects of spaceflight exposure. “It’s been 30 years, and in many ways it hasn’t been superseded yet,” he said. Participating in Skylab’s scientific mission was also a thrill for Carr.

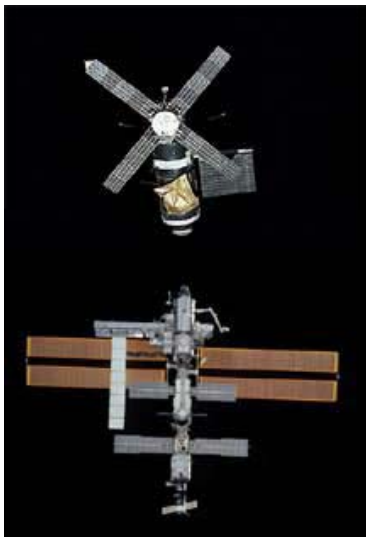
“We were just gathering information where no other information had ever been





gathered,” he said. “Most of the stuff done by the Russians (on the effects of spaceflight exposure) until then was pretty much anecdotal in nature.”

Garriott even has another point of reference for his perspective on Skylab as an orbital science laboratory. Ten years after his Skylab mission, he returned to space a second time on a 10-day Space Shuttle mission. During that flight, he worked on the Spacelab orbital science module carried in the Shuttle’s cargo bay. “Skylab, in a way, was more interesting” due to the longer duration of the mission, he said. “Spacelab, in its way, was a remarkable laboratory also.” The changes in technology also made a big difference, he said. “With Skylab, 30 years ago, you were just beginning to get into automated systems,” he said. “Spacelab had moved well beyond it.” (However, he noted, in terms of computer capability, neither station would compare to a modern home computer.)



When asked about the modern successor to the Skylab program, Garriott said that he believes the ISS could have a great future. “It’s got great potential, but not with only two people onboard. We’re still waiting expectantly for the potential to be realized.” He said that he believes the ISS could be a very productive scientific facility once the crew size is increased.

Kerwin said that he believes the U.S. should have launched another space station more like Skylab before moving on to ISS. “I think it’s too big,” he said. Kerwin added, however, that he believes the current Space Station is a “magnificent achievement,” and that its construction so far has been remarkable.

Carr said that he and fellow third-crew astronaut Pogue were actually involved in the development of what became ISS for 13 years, and were able to share their experiences during the design planning. “It looks to me like it’s a good system,” he said. Carr agreed with Garriott that ISS has the potential to yield great scientific results if “we keep people moving through that thing.” He said he believes that increasing the size of the ISS crew is one of the greatest priorities in realizing its potential.

The ISS still has a long future, and NASA and its international partners are working to make sure that ISS does realize its full potential. And, when it does, it will owe much of that success to another space station, which orbited the Earth 30 years ago—Skylab.



*Courtesy of NASA's  
Space Flight Enterprise*